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# RAIL SHIPPING TESTS WITH LONG ISLAND CAULIFLOWER - 1950

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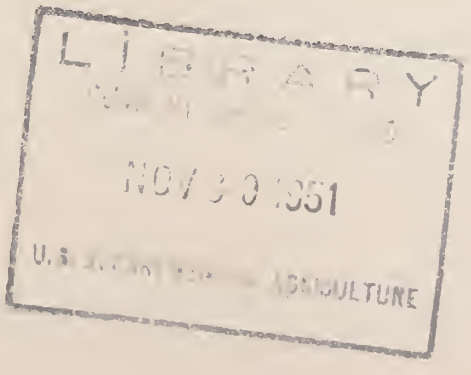


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# Rail Shipping Tests with Long Island Cauliflower - 1950

## Introduction

This report 1/ summarizes the results of six shipping tests with Long Island cauliflower made during October and November, 1950, from Riverhead, New York. Each test was comprised of two commercial carlots. The work was a continuation of that initiated during the previous season, 2/ and was carried out with the cooperation of the Long Island Cauliflower Distributors.

## Methods

Because of the favorable results obtained in the 1949 tests only the 381-crate load was used in the tests of 1950. This load is a non-stripped "through" load consisting of (1) 15 stacks in which the crates are placed on their sides lengthwise of the car, six rows wide and four layers high; and (2) a sixteenth stack at one end of the car in which the crates are placed on end, seven rows wide and three layers high. The Long Island wirebound crate was used in all tests.

The purpose of the tests was to compare different methods of refrigeration in fan cars and in non-fan cars of 381-crate loads.

The general plan for each test was to load and ship two cars under as nearly identical conditions as possible except for the variation in method of refrigeration (and/or car type) under comparison.

On the day of loading, two cars as nearly alike in general condition as could be found on the siding were selected and prepared for the test by attaching the electric resistance thermometer equipment to the ceiling of the car. The lead from the cable was passed out of the car by means of the door plate so that temperatures within the car could be read after the doors had been closed. During loading, which usually lasted about an hour, the electric resistance thermometers were inserted into the center of cauliflower heads in crates located respectively in the bottom layer, the next to the bottom layer (head in upper part of crate), and the top layer at (1) bunker, (2) quarterlength, and (3) doorway positions at the centerline of the car. Opportunity was thus afforded for obtaining commodity temperatures at nine representative locations in the load. By means of three other electric resistance thermometers air temperatures were obtained at bottom bunker, bottom doorway and top doorway positions at centerline of car. Continuous records of transit temperatures at two quarterlength centerline positions in the load were obtained by means of self-recording Ryan thermometers placed securely in the center of test packages. A Ryan thermometer was also attached underneath and on the outside of each car in order to obtain a continuous record of outside air temperatures.

1/ Part of a Research and Marketing Act project (RM:a-165) on the handling, distribution and marketing of vegetables in the northeastern states.

2/ Kaufman, J., Hruschka, H. W., and Wiant, James S. Rail Shipping Tests with Long Island Cauliflower - 1949. U. S. Dept. Agr., H. T. & S. Office Report No. 228, July, 1950. (Processed).

Bulkhead openings of the bunkers of non-fan cars that were not to be iced, except for top ice, were covered with heavy paper before loading.

Only cauliflower that appeared to be in good condition was used in the test cars. During the loading operation half of each truckload was placed in one car and half in the other car; this was repeated until loading was completed. The contents of the two cars were thus nearly identical. Unless indicated otherwise, both cars of a test were shipped together to the same market.

Temperature records were taken periodically by means of the resistance thermometer equipment from the time loading was completed until the time the cars were moved off the siding just prior to shipment. Temperature readings were then taken on the day after shipment while the cars were en route through the New York City area. All cars were met at destination by an observer who again made temperature readings and inspected the arrival condition of the load and of the cauliflower. Inspections at destination were also made by Federal P.M.A. inspectors and, whenever possible, by representatives of the railroad inspection agencies.

## Results

Cars 1 and 2: Comparison in non-fan cars between the use of top ice alone and top ice supplemented with bunker ice.

Both cars were loaded at Riverhead on the afternoon of October 10 and were moved out that night.

Car 1 was initially top-iced only (18,000 pounds) [3/] and shipped L.I.R.R., P.R.R., Frisco to St. Louis, Missouri, where it arrived on October 15. At that time approximately 2,000 pounds of top ice remained over most of the load, but with some crates bare. The crates in from one to three of the uppermost layers were somewhat out of line, and were leaning toward the sidewalls at various angles. A few crates had broken slats, although the contents were intact and undamaged. The cauliflower was in excellent condition, with the curds mostly white and the jacket leaves fresh and green. No decay was observed.

Car 2 was initially iced with 18,000 pounds of top ice and 9,600 pounds of bunker ice and was not reiced. It was shipped L.I.R.R., P.R.R., Illinois Central to New Orleans, Lousiana, where it arrived October 18. Approximately 1,500 pounds of top ice remained over most of the load, but some crates were bare. The bunkers were about half full, and about 4,800 pounds of bunker ice remained. The cauliflower was in excellent condition; the jacket leaves were fresh and green, the curds were mostly white and no decay was observed.

Outside air temperatures at the time of loading ranged between 67° F. and 70° F.; commodity temperatures were one or two degrees lower. Outside air temperatures were moderate during most of the transit period, with an average daily mean of approximately 60° F. until October 15. Although the outside air temperature record for the New Orleans car was incomplete, the car moved through considerably warmer weather during the period of October 15 to 18 than during the first days en route.

3/ All estimates of ice supplied were based on block counts.

Temperatures taken with the electrical resistance thermometers while the cars were still on track at Riverhead, while they were en route through New York, and after their arrival at the market are given in detail in tables 1 and 2. Between 5:00 p.m. and 9:30 p.m. on the day of loading, the average commodity temperature in car 1 dropped from 68° F. to 61° F. and in car 2 from 64° F. to 55° F., with an average temperature difference between the two cars of approximately five degrees. The same difference prevailed at New York where readings were taken about twenty-four hours after the cars were loaded. On arrival at destination commodity temperatures were rather uniformly in the middle thirties throughout both loads and averaged only slightly lower in car 2 than in car 1.

Temperatures at two quarterlength positions recorded by the Ryan thermometers and summarized in table 13 indicate that commodity temperatures in both cars continued to drop after the time of the New York City reading so that by about forty-eight hours after the time of loading they had stabilized near the point where they were noted at destination.

Conclusions from test with cars 1 and 2

The use of bunker ice along with top ice resulted in slightly more rapid cooling of the load during the early part of the transit period. Since the arrival inspection at New Orleans of the car with both top ice and bunker ice was made three days after that of the St. Louis car, direct comparisons at destination were not available. Approximately 5,300 pounds more ice (i.e. 4,800 pounds of bunker ice and 500 pounds of top ice) was melted in the New Orleans car than in the other car. Whether the New Orleans car would have arrived with as satisfactory temperatures and with as good a condition of the load if bunker ice had not been used is problematical. Under conditions where unusually warm cauliflower is loaded for shipment to the more distant markets the use of bunker ice along with top ice might well be advisable.

Cars 3 and 4: Comparison of a non-fan car shipped with top ice only and a fan car precooled and shipped under standard refrigeration without use of top ice.

Both cars were loaded on the afternoon of October 11 and shipped a day apart by L.I.R.R., P.R.R., Frisco to St. Louis, where they arrived on October 17 and 18 respectively.

Car 3, the non-fan car, was initially iced with 18,000 pounds of top ice and shipped out the night of October 11. Upon arrival, two to ten inches of top ice remained over the load (but with many bare spots) and the total top ice remaining was estimated as amounting to 1,500 pounds. There was some overriding of crates in the upper layers, although the load was considered to be in generally good condition. The cauliflower was in good condition, with curds mostly white and crisp and leaves fresh and green. No decay was noted.

Car 4, the fan car, was preiced with 11,300 pounds of bunker ice (full bunkers), replenished during precooling by the shipper with 5,400 pounds, and reiced four times in transit with 7,500 pounds, giving a total of 24,200 pounds of ice supplied. No top ice was used. The load was precooled for a total of 22.5 hours by means of

the built-in car fans operated by Preco portable electric motors. The car was thus held over for one day and shipped out on the night of October 12. Upon arrival approximately 9,900 pounds of ice remained in the bunkers. Although the load was in generally good condition there was a four to eleven inch shift away from the bunker in one end of the car as well as a leaning of the rows towards the side of the car. The crates were considered by most observers to be more attractive than those of the top-iced car because of their dry, clean appearance. The cauliflower was in good condition, with the curds white, the leaves green, and with no evidence of decay. The leaves were, however, slightly less turgid than those in the top-iced car, with the result that there was a slightly less tight pack. This was not considered to have commercial significance.

The outside air temperature during loading averaged 68° F. The commodity temperatures ranged between about 59° F. and 62° F. For both cars an average daily mean air temperature of about 62° F. was encountered during the transit period.

From the temperature data in tables 3 and 4 it will be seen that during the six-hour period when the cars were under direct comparison (3:30 p.m. to 9:30 p.m., October 11) the two loads cooled at approximately the same rate. Thus, in the top-iced car the commodity temperature dropped nine degrees, to average 51° F. at 9:30 p.m. and in the fan-precooled dry-load car it dropped ten degrees to average 49° F. Likewise, in early afternoon of October 12 (at which time the top-iced car was in New York City) commodity temperatures were practically identical in the two cars. However, readings made on both cars at St. Louis on October 18 showed that commodity temperatures were somewhat lower in the top-iced car than in the other car. Records obtained by Ryan thermometers at quarterlength positions (table 13) show that in thirty-six hours after loading commodity temperatures in the precooled load leveled off at 36° F. to 38° F. and continued at about that point until near the end of the transit period, after which they rose slightly; in the top-iced car they leveled off (one position) at 36° F. seventy-two hours after loading and then dropped to 34° F. for the latter part of the transit period.

Conclusions from test with cars 3 and 4

This test shows very clearly the drop in commodity temperature that can be expected from different periods of precooling. Thus, for the six-hour period extending from start of precooling (3:30 p.m.) to the time precooling would have been terminated if the car were to have moved out on the day of loading (9:30 p.m.), there was an average commodity temperature drop of ten degrees. During the entire 22.5 hours that the fans were in continuous operation the average commodity temperature dropped at the approximate rate of one degree per hour. As already indicated, equally good refrigeration was obtained from the use of only top ice in a non-fan car.

Cars 5 and 6: Comparison of top-iced non-fan car with top-iced fan car.

A comparison was made between a non-fan car (car 5) and a fan car (car 6), both of which were loaded on the afternoon of October 26, top-iced with 18,000 pounds ice and shipped out that night for St. Louis 4/ by L.I.R.R., P.R.R., Frisco. They arrived at destination October 30.

4/ Car 5 was unloaded actually at Fairmont City, Illinois on the P.R.R.

The weather was unusually cool on the day of loading, with an air temperature of 54° F. and a commodity temperature of 46° F. Outside air temperatures averaged 59° F. during the transit period, although they were in the upper eighties at the time of unloading.

From a comparison of the data given in tables 5, 6 and 13 it will be seen that from the time the cars were iced until the readings were made on October 30 there was no essential difference between the two cars with respect to commodity temperatures. While the cars were still on track at Riverhead, cooling of the cauliflower was somewhat slower at both top and bottom bunker positions in the fan car than in the non-fan car. This may have been partly due to the fact that the bunker openings were papered shut in the non-fan car. Commodity temperatures at the two quarter-length positions were in the middle thirties in both cars during the period of transit between New York City and destination. Commodity temperatures at destination were somewhat more uniform throughout the fan car than throughout the non-fan car, due to the operation of the car fans during transit; on October 30, at destination, they averaged 36° F. in car 5 and 35° F. in car 6.

Inspections at destination indicated that both cars arrived in good order. No recooperage was necessary. Approximately 7,500 pounds of ice remained over the top of the load in the non-fan car and 6,000 pounds in the fan car. No significant changes in quality of the cauliflower were noted from the time the crates were loaded into the cars until they were unloaded. The cauliflower in both cars was fresh, the heads compact, and the curds generally white. The jacket leaves were of good green color. No decay was noted.

Conclusions from test with cars 5 and 6

Any conclusions drawn from the results of this test should be qualified by the fact that the commodity was at a relatively low temperature when loaded into the car. Under the conditions of the test there appeared to have been no difference in behavior between fan cars and non-fan cars when the load was shipped under top ice only. Where only fan cars are available for top-iced loads it would appear advisable not to paper the bunker openings, and the cars should be shipped with the fans in the operating position.

Cars 7 and 8: Non-fan top-iced car compared with non-fan car which received both top ice and upper-half-stage bunker ice.

These non-fan cars were loaded on October 30 and shipped together to Detroit by L.I.R.R., D. L. & W., and P.M. Car 7 received 18,000 pounds of top ice; car 8 in addition to receiving the same amount of top ice also received 4,800 pounds of bunker ice. A grating confined this ice to the upper half of the bunkers (half-stage icing).

At the time of loading, the outside air temperature was 74° F. and the commodity temperature averaged 63° F. During transit the outside air temperature fell gradually to the middle forties at destination and averaged approximately 54° during the four-day period.

The top-iced car supplemented with half-stage icing cooled more rapidly and more uniformly than did its companion car. At the time of departure from Riverhead the average commodity temperature was five degrees lower in the car receiving both top ice and bunker ice than that of the other car. At New York City the difference was four degrees. However, it should be pointed out that although both cars were top-iced at the same time (3:30 p.m.), car 8 had been bunker-iced an hour earlier. This may partially account for the somewhat lower commodity temperatures noted in car 8 at any given hour up to and including the time the readings were made at New York City. It will be noted that between the hours of 3:30 p.m. and 8:30 p.m. on the day of loading the average commodity temperature dropped ten degrees in car 7 and eleven degrees in car 8.

Commodity temperatures at two quarterlength positions in each car were in the middle thirties during transit between New York and Detroit. At destination commodity temperatures ranged from 34° F. to 37° F. in car 7 and 33° F. to 35° F. in car 8.

Both cars arrived at Detroit on November 3 and were unloaded during a three-day period. Upon arrival there was approximately 6,000 pounds of top ice remaining over the load in car 7 and approximately 7,500 pounds in car 8. Approximately 2,400 pounds of bunker ice remained in the latter car(i.e. 1,200 pounds per bunker). A 2 to 4 inch lengthwise shift was noted in both cars. From 1 to 2 percent of the crates in each car required recoopering because of loose or broken slats, but most damaged crates were made good.

The cauliflower in both cars arrived in good condition and had changed little, if any, during transit. The leaves were generally fresh and crisp; the curds were compact and mostly white to creamy white. No decay was noted. There was no difference between the cars with respect to condition of the commodity.

Conclusions from test with cars 7 and 8

Under the conditions of the test where moderately warm cauliflower was shipped in non-fan cars to Detroit, and where the cars moved mostly under very cool weather, there appeared to be little, if any, commercial advantage of supplementing top ice with upper-half-stage bunker ice.

Cars 9 and 10: Comparison of a fan car shipped with top ice only and a fan car shipped under standard refrigeration without use of top ice.

Both fan cars were loaded on the afternoon of November 8 and shipped together that night via L.I.R.R., B. & O. to Chicago, where they arrived November 12. Fans were sealed in operating position.

Car 9 was initially iced with 18,000 pounds of top ice. Upon arrival an estimated 6,000 pounds of ice remained over the load. There was some shifting of upper layer crates and about 5 percent of the crates in the car required some recoopering. The cauliflower was in good condition,with the curds compact and generally white and the jacket leaves fresh and green, with no decay.

Car 10 was bunker iced with 10,000 pounds (full bunkers) and reiced twice in transit with 5,000 pounds, for a total of 15,000 pounds. No top ice was used. Upon arrival at Chicago approximately 6,200 pounds of bunker ice remained in the car. The load was in good condition and no crates required recoopering. The cauliflower was likewise in good condition, with the heads compact and generally white, and the leaves fairly fresh and green. No decay was noted. It should be pointed out, however, that the jacket leaves were slightly crisper and fresher in the top-iced car (car 9).

The outside air temperatures during the period of loading averaged 63° F. Commodity temperatures at time of loading averaged 61°. During the first day of transit the outside air temperature averaged approximately 56° but fell rapidly to the low thirties for the next three days.

From the data in tables 9 and 10 it can readily be seen that cooling was more rapid in the top-iced car. Thus, during the four-hour period during which temperature readings were taken at Riverhead (i.e. 4:50 p.m. to 8:50 p.m.) the average commodity temperature dropped six degrees in the top-iced car and only one degree in the bunker-iced car. However, after the cars began to move (and thus the fans to operate) the rate of cooling was greatly accelerated in the bunker-iced car. Thus, between the time of the last reading at Riverhead (8:50 p.m. of November 8) and the time of the New York City reading (2:35 p.m. of November 9) the average commodity temperature was reduced from 60° F. to 52° F. in the bunker-iced car and from 53° F. to 43° F. in the top-iced car.

Commodity temperatures at two quarterlength positions during the period of transit between New York City and Chicago (table 13) were on the average about four degrees to five degrees lower in the top-iced car than in the bunker-iced car. Average commodity temperatures at destination (tables 9 and 10) were 34° F. in the top-iced car and 36° F. in the bunker-iced car.

Conclusions from test with cars 9 and 10

The use of top ice only in a fan car gave much more rapid cooling of the load than did bunker ice only, in a fan car during the period between the time of loading and the time the cars were shipped. It is believed that the rate of cooling would have been much more nearly uniform in the two cars if the cars had been shipped immediately after loading.

Cars 11 and 12: Comparison of a fan car shipped with top ice only, and a fan car precooled six hours and shipped under standard refrigeration without top ice.

Both cars were loaded on the afternoon of November 9 and shipped that night to Chicago, where they arrived November 13. One car (No. 11, top ice only) moved via L.I.R.R., D. L. & W., N.K.P.; the other car via L.I.R.R., B. & O., so that they did not travel together beyond New York City.

Car 11 received 18,000 pounds of top ice two hours after loading and was not reiced in transit. The bulkhead openings were not papered. Upon arrival approximately 7,500 pounds of ice remained over the top of the load. There was some "over-riding" of upper layer crates, with some crates broken and requiring recoopering. There was practically no change in the condition of the cauliflower during the transit period. Upon arrival the curds were mostly compact and white. Jacket leaves were generally fresh and of good green color. No decay was noted.

Car 12 (fan car) contained approximately 4,800 pounds of bunker ice at the time loading was completed and the precooling fans started. About two hours later the bunkers were replenished with 6,000 pounds of ice. Bunkers were reiced twice in transit with 7,400 pounds for a total of 18,200 pounds. The load was precooled for six hours by means of built-in car fans operated by Preco portable electric motors. Upon arrival in Chicago approximately 8,700 pounds of ice remained in the bunkers. There was some overriding of upper layer crates, but none required recoopering. The cauliflower arrived in good condition. The jacket leaves were generally fresh and green, and the curds mostly compact and white.

Outside air temperature at time of loading ranged from 65° F. to 68° F. Commodity temperatures at time of loading averaged 63° F. The outside air temperature averaged about 50° F. to 55° F. during the first one and a half days of transit and in the low thirties thereafter.

Car 11 was top iced at 5:15 p.m. of November 9 (table 11). At that time (5:20 p.m.) the average commodity temperature was 62° F.; this fell to 53° F. by the time the last temperature readings were made at Riverhead (9:50 p.m.). There was thus a nine degree drop in average commodity temperature during the four and one-half hours that the car was under observation on the loading track.

From table 12 it will be noted that the commodity temperature readings at Riverhead were generally lower in precooled car No.12 than in the top-iced car. It should be pointed out, however, that the precooling fans were started at 3:20 p.m. or two hours earlier than the time car 11 was top iced. During the four hour period extending from 5:20 p.m. to 9:20 p.m. the average commodity temperature fell from 56° F. to 46° F., or a drop of ten degrees as compared with cooling from 62° to 54°, or eight degrees in car 11. Thus, during the only period in which the loads were comparable while on track at Riverhead the rate of cooling was slightly greater in the fan-precooled car than in the top-iced car despite a lower initial temperature in the fan-precooled car.

There was, however, a marked difference between the two loads with respect to further cooling between the time of the last Riverhead reading and that of the New York reading. Thus, for top-iced car No. 11 the average commodity temperature fell from 53° F. (9:50 p.m., November 9) to 37° F. (9:15 p.m., November 10) or a drop of 16 degrees. For precooled car No. 12 the average commodity temperature fell from 46° F. (9:50 p.m., November 9) to 45° F. (5:00 p.m., November 10) or a drop of only 1 degree as compared with sixteen degrees in car 11. Putting it another way, although the precooled load was seven degrees cooler than the top-iced load at the time of the last Riverhead reading, it was eight degrees warmer at New York. In this connection it should be noted that the New York readings on the fan-precooled load (as well as on the top-iced load) were made late in the day so that the car undoubtedly was standing on track for many hours with the fans not operating.

Temperatures recorded by Ryan thermographs at two quarterlength positions show that transit temperatures were definitely lower in the top-iced car (table 13). However, upon arrival in Chicago commodity temperatures throughout the load were almost identical (average of 34° F. and 35° F.) in the two cars (tables 11 and 12).

Conclusions from test with cars 11 and 12.

In this comparison of a fan-precooled fan car, not top-iced, and a non-precooled top-iced fan car there was no great difference in the rate of cooling between the two loads as long as the precooling fans were operating (six hours in the present instance). However, after precooling was discontinued further cooling progressed much more slowly in the fan-precooled car. This was in contrast with the results from Car 10 (non-precooled fan car shipped under standard refrigeration) where transit cooling between Riverhead and New York City was essentially the same as in the top-iced car. It is difficult to make comparisons with fan-precooled car 4 since commodity temperatures averaged 38° F. in that car before it left Riverhead.

## Commercial Considerations 5/

Although none of the six two-car tests was repeated during the course of the season's work the nature of each test was such that fairly accurate comparisons can be made.

Perhaps the most significant fact brought out by the tests was that by the application of 18,000 pounds of top ice after loading excellent commodity temperatures were rapidly attained in these 381-crate loads and were maintained during transit.

The results obtained with the New Orleans car suggest that cars loaded with fairly warm cauliflower and shipped to the more distant markets might well profit by the use of bunker ice along with top ice. The data are too limited to conclude whether in such instances upper-half-bunker icing (stage icing) would be satisfactory as full bunker icing.

Although fan cars are of more value for shipments of fruits and vegetables that are not top-iced, the tests indicated no objection to their use for such purposes. Where fan cars are used for top-iced loads the bulkhead openings should not be papered and the fan levers should be placed in the "on" or operating position.

Three of the six tests included a fan car shipped "dry" (i.e. without top ice) under standard refrigeration. In such loads the crates were more readily handled at destination since they were dry and there was no ice present among them. The cauliflower in these loads had slightly less leaf turgidity and thus had a slightly loose pack in the crate. However, this appeared to be of very little if any commercial importance. At the same time the three tests demonstrated conclusively that the cauliflower was not injured by the use of top ice and, hence, by the wetting of the product.

5/ For convenience of comparison a summary of all ice records is presented in table 14, and average commodity temperatures in the six pair of test cars are presented in figures 1 to 6.

Where a dry load was shipped in a fan car under standard refrigeration without car-fan precooling, the load cooled very slowly during the time the car was held on track prior to shipment. This method of refrigeration can not be recommended although it might be successful if the cars were shipped (with fans operating) soon after the time of loading.

Where dry loads destined for shipment under standard refrigeration were iced to full bunker capacity and precooled on track with the built-in car fans operated by portable electric motors, the rate of cooling throughout the load was only slightly more rapid than in companion cars that were not precooled with fans and in which only top ice was employed. At the same time the tests show in considerable detail the time required for obtaining any given amount or extent of precooling. On the basis of two such precooling tests the average commodity temperature throughout the precooled load dropped at the rate of about two degrees per hour during the first six hours of precooling. Ordinarily six hours represents about the average length of time that cars would be available for precooling of the loads. Where a car was held over for shipment on the day after loading the average rate of precooling was approximately one degree per hour for the entire 22.5-hour period of precooling.

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Table 1. Summary of temperatures obtained with resistance thermometers in Car 1.
Non-fan car shipped with top ice only.

| | | | | Air Temp. (° F.) 1/ | | | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 10/10 | 3:00p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 3:40p | 68 | 68 | 68 | 70 | 69 | 69 | 70 | 69 | 70 | 70 | 70 | 71 | 69 | 69 | 70 | 70 | 70 |
| " | " | 5:00p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 5:00p | 62 | 62 | 58 | 47 | 68 | 69 | 70 | 63 | 67 | 69 | 69 | 69 | 69 | 67 | 68 | 69 | 68 |
| " | " | 5:30p | 60 | 60 | 54 | 47 | 66 | 69 | 69 | 59 | 65 | 68 | 66 | 68 | 65 | 64 | 67 | 67 | 66 |
| " | " | 6:00p | 59 | 56 | 53 | 46 | 66 | 69 | 69 | 58 | 63 | 68 | 66 | 68 | 65 | 63 | 67 | 67 | 66 |
| " | " | 6:30p | 59 | 52 | 50 | 44 | 65 | 68 | 67 | 55 | 61 | 66 | 63 | 66 | 62 | 61 | 65 | 65 | 64 |
| " | " | 7:00p | 59 | 50 | 49 | 43 | 65 | 68 | 66 | 54 | 59 | 65 | 63 | 66 | 62 | 61 | 64 | 64 | 63 |
| " | " | 8:00p | 60 | 48 | 47 | 42 | 65 | 67 | 64 | 52 | 57 | 63 | 61 | 65 | 60 | 59 | 63 | 62 | 62 |
| " | " | 9:30p | 62 | 46 | 46 | 43 | 65 | 67 | 62 | 51 | 55 | 61 | 61 | 65 | 59 | 59 | 62 | 61 | 61 |
| N.Y.C. | 10/11 | 3:00p | 66 | 39 | 40 | 41 | 53 | 54 | 46 | 42 | 41 | 43 | 51 | 53 | 46 | 49 | 49 | 45 | 48 |
| St.Louis | 10/15 | 11:45a | 80 | 33 | 36 | 42 | 44 | 38 | 37 | 35 | 35 | 35 | 34 | 37 | 36 | 38 | 37 | 36 | 37 |
| " | " | " | 2:55p | 80 | 35 | 36 | 45 | 44 | 38 | 37 | 35 | 35 | 35 | 34 | 37 | 36 | 38 | 37 | 36 | 37 |

1/ All temperatures taken in centerline of car.
Position: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST = outside air temperature.

Table 2. Summary of temperatures obtained with resistance thermometers in Car 2.
Non-fan car shipped with top ice and with full bunkers (initial icing only).

| | | | | Air Temp. (° F.) 1/ | | | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 10/10 | 1:00p | | Bunkers iced. | | | | | | | | | | | | | | | |
| " | " | 3:15p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 3:40p | 68 | 39 | 49 | 67 | 68 | 67 | 67 | 67 | 67 | 69 | 69 | 69 | 67 | 68 | 67 | 68 | 68 |
| " | " | 4:30p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 4:35p | 63 | 36 | 42 | 49 | 67 | 67 | 65 | 62 | 66 | 68 | 64 | 67 | 64 | 64 | 67 | 66 | 66 |
| " | " | 5:00p | 62 | 35 | 41 | 49 | 66 | 67 | 65 | 60 | 65 | 65 | 61 | 67 | 62 | 62 | 66 | 64 | 64 |
| " | " | 5:30p | 60 | 35 | 40 | 47 | 64 | 65 | 64 | 58 | 64 | 63 | 58 | 65 | 59 | 60 | 65 | 62 | 62 |
| " | " | 6:00p | 59 | 35 | 39 | 47 | 64 | 64 | 61 | 57 | 63 | 63 | 58 | 65 | 58 | 60 | 64 | 61 | 61 |
| " | " | 6:30p | 59 | 35 | 38 | 47 | 63 | 63 | 61 | 56 | 63 | 61 | 57 | 64 | 56 | 59 | 63 | 59 | 60 |
| " | " | 7:00p | 59 | 35 | 46 | 45 | 61 | 61 | 60 | 53 | 61 | 59 | 54 | 62 | 54 | 56 | 61 | 57 | 58 |
| " | " | 8:00p | 60 | 34 | 34 | 44 | 59 | 59 | 57 | 51 | 58 | 56 | 53 | 59 | 51 | 54 | 59 | 55 | 56 |
| " | " | 9:30p | 62 | 34 | 34 | 44 | 59 | 58 | 56 | 51 | 58 | 54 | 52 | 59 | 50 | 54 | 58 | 53 | 55 |
| N.Y.C. | 10/11 | 3:00p | 66 | 34 | 33 | 39 | 42 | 45 | 42 | 42 | 47 | 42 | 44 | 42 | 38 | 43 | 45 | 41 | 43 |
| N.Orleans | 10/18 | 8:00a | 69 | 36 | 33 | 43 | 38 | 36 | 36 | 35 | 34 | 37 | 36 | 33 | 35 | 36 | 34 | 36 | 36 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST = outside air temperature.

Table 3. Summary of temperatures obtained with resistance thermometers in Car 3.
Non-fan car shipped with top ice only.

| | | | | Air Temp. 1/ (° F.) | | | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhead | 10/11 | 2:30p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 2:30p | 68 | 63 | 65 | 67 | 64 | 62 | 61 | 62 | 61 | 59 | 62 | 60 | 61 | 63 | 61 | 60 | 61 |
| " | " | 3:20p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 3:30p | 67 | 51 | 59 | 48 | 61 | 61 | 58 | 60 | 60 | 58 | 58 | 60 | 61 | 60 | 60 | 59 | 60 |
| " | " | 3:45p | 66 | 50 | 58 | 48 | 59 | 60 | 58 | 59 | 59 | 57 | 57 | 59 | 59 | 58 | 59 | 58 | 59 |
| " | " | 4:00p | 64 | 50 | 58 | 48 | 59 | 60 | 58 | 59 | 58 | 57 | 57 | 60 | 60 | 58 | 59 | 58 | 59 |
| " | " | 4:30p | 64 | 47 | 56 | 47 | 57 | 59 | 57 | 59 | 60 | 57 | 56 | 60 | 60 | 57 | 60 | 58 | 58 |
| " | " | 5:00p | 64 | 46 | 55 | 46 | 55 | 58 | 56 | 57 | 59 | 56 | 55 | 59 | 59 | 56 | 59 | 57 | 57 |
| " | " | 5:30p | 62 | 45 | 54 | 46 | 54 | 57 | 56 | 57 | 59 | 56 | 54 | 59 | 59 | 55 | 58 | 57 | 57 |
| " | " | 6:00p | 62 | 44 | 53 | 45 | 52 | 55 | 55 | 56 | 58 | 55 | 53 | 59 | 58 | 54 | 57 | 56 | 56 |
| " | " | 6:30p | 62 | 44 | 52 | 45 | 51 | 55 | 55 | 56 | 58 | 55 | 53 | 59 | 58 | 53 | 57 | 56 | 56 |
| " | " | 7:30p | 62 | 43 | 50 | 45 | 49 | 53 | 53 | 54 | 58 | 54 | 53 | 58 | 57 | 52 | 56 | 54 | 54 |
| " | " | 8:30p | 62 | 42 | 49 | 43 | 47 | 51 | 52 | 53 | 56 | 52 | 48 | 57 | 55 | 49 | 55 | 53 | 52 |
| " | " | 9:30p | 62 | 41 | 47 | 44 | 45 | 50 | 51 | 52 | 56 | 51 | 46 | 56 | 54 | 48 | 54 | 52 | 51 |
| N.Y.C. | 10/12 | 2:00p | 56 | 40 | 41 | 40 | 36 | 40 | 43 | 43 | 48 | 43 | 39 | 47 | 45 | 39 | 45 | 44 | 43 |
| E.St.Louis | 10/16 | 1:30p | 83 | 33 | 36 | 45 | 33 | 35 | 35 | 34 | 33 | 36 | 34 | 35 | 37 | 34 | 34 | 36 | 35 |
| St.Louis | 10/17 | 9:30a | 76 | 36 | 37 | 44 | 34 | 35 | 35 | 34 | 33 | 36 | 34 | 35 | 37 | 34 | 34 | 36 | 35 |
| " | " | " | | 4:30p | 85 | 35 | 38 | 51 | 34 | 35 | 35 | 34 | 33 | 36 | 34 | 35 | 37 | 34 | 34 | 36 | 35 |
| " | " | 10/18 | 4:30p | 83 | 36 | 38 | 60 | 35 | 35 | 36 | 35 | 34 | 36 | 36 | 35 | 37 | 35 | 35 | 36 | 35 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST = outside air temperature.

Table 4. Summary of temperatures obtained with resistance thermometers in Car 4.
Fan car precooled and shipped dry (i.e. without top ice) under standard refrigeration.

| | | | | Air Temp. (° F.) 1/ | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 10/11 | 10:30a | | Bunkers iced. | | | | | | | | | | | | | | | |
| " | " | 2:45p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 2:45p | 68 | 47 | 48 | 64 | 59 | 59 | 56 | 61 | 61 | 60 | 61 | 61 | 60 | 60 | 60 | 59 | 60 |
| " | " | 3:30p | | Fans started. | | | | | | | | | | | | | | | |
| " | " | 3:30p | 67 | 51 | 48 | 59 | 59 | 59 | 55 | 61 | 60 | 56 | 61 | 61 | 59 | 60 | 60 | 57 | 59 |
| " | " | 4:00p | 64 | 54 | 50 | 48 | 58 | 58 | 56 | 58 | 58 | 57 | 61 | 60 | 58 | 59 | 59 | 57 | 58 |
| " | " | 4:30p | 64 | 53 | 48 | 47 | 57 | 57 | 56 | 58 | 56 | 56 | 60 | 59 | 57 | 58 | 57 | 56 | 57 |
| " | " | 5:00p | 64 | 51 | 47 | 46 | 56 | 56 | 56 | 57 | 54 | 55 | 59 | 58 | 56 | 57 | 56 | 56 | 56 |
| " | " | 5:30p | 62 | 50 | 46 | 45 | 55 | 55 | 55 | 56 | 53 | 54 | 57 | 56 | 55 | 56 | 55 | 55 | 55 |
| " | " | 6:00p | 62 | 49 | 45 | 44 | 54 | 55 | 54 | 54 | 52 | 53 | 55 | 55 | 54 | 54 | 54 | 54 | 54 |
| " | " | 6:30p | 62 | 48 | 44 | 43 | 53 | 53 | 53 | 53 | 51 | 51 | 54 | 54 | 53 | 53 | 53 | 52 | 53 |
| " | " | 8:30p | 62 | 46 | 44 | 42 | 50 | 51 | 51 | 50 | 47 | 49 | 50 | 50 | 50 | 50 | 49 | 50 | 50 |
| " | " | 10:30p | 63 | 44 | 43 | 41 | 48 | 49 | 50 | 47 | 45 | 47 | 47 | 48 | 48 | 47 | 47 | 48 | 48 |
| " | 10/12 | 12:30a | 62 | 42 | 41 | 40 | 45 | 46 | 47 | 44 | 42 | 44 | 44 | 45 | 45 | 44 | 44 | 45 | 45 |
| " | " | 2:30a | 61 | 41 | 41 | 39 | 43 | 45 | 45 | 42 | 41 | 43 | 43 | 43 | 44 | 43 | 43 | 44 | 43 |
| " | " | 4:30a | 61 | 39 | 40 | 38 | 41 | 43 | 44 | 41 | 40 | 41 | 41 | 41 | 42 | 41 | 41 | 42 | 42 |
| " | " | 6:30a | 62 | 39 | 39 | 38 | 40 | 42 | 43 | 40 | 39 | 40 | 41 | 41 | 42 | 40 | 41 | 41 | 41 |
| " | " | 8:30a | 62 | 39 | 39 | 38 | 39 | 41 | 42 | 39 | 39 | 39 | 40 | 40 | 40 | 39 | 40 | 40 | 40 |
| " | " | 10:30a | 59 | 39 | 39 | 38 | 39 | 41 | 41 | 39 | 38 | 39 | 39 | 39 | 40 | 39 | 39 | 40 | 39 |
| " | " | 11:25a | | Bunkers replenished. | | | | | | | | | | | | | | | |
| " | " | 11:30a | - | 38 | 38 | 38 | 38 | 40 | 41 | 38 | 38 | 39 | 39 | 39 | 40 | 38 | 39 | 40 | 39 |
| " | " | 2:00p | - | 37 | 37 | 36 | 37 | 39 | 40 | 37 | 37 | 38 | 38 | 38 | 38 | 37 | 38 | 39 | 38 |
| " | " | 2:00p | | Fans stopped. | | | | | | | | | | | | | | | |
| N.Y.C. | 10/13 | 1:30p | 58 | 37 | 39 | 42 | 39 | 39 | 39 | 40 | 39 | 40 | 40 | 40 | 39 | 40 | 39 | 39 | 39 |
| E.St.Louis | 10/17 | 2:30p | 77 | 37 | 40 | 45 | 38 | 38 | 38 | 38 | 37 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 |
| St.Louis | 10/18 | 4:00p | 83 | 36 | 40 | 51 | 41 | 38 | 37 | 40 | 38 | 38 | 40 | 39 | 39 | 40 | 38 | 38 | 39 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST = outside air temperature.

Table 5. Summary of temperatures obtained with resistance thermometers in Car 5.
Non-fan car shipped with top ice only.

| | | | Air Temp. (° F.) 1/ | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 10/26 | 3:15p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 3:20p | 54 | 49 | 54 | 54 | 46 | 43 | 44 | 44 | 47 | 48 | 43 | 44 | 46 | 44 | 45 | 46 | 45 |
| " | " | 4:00p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 4:00p | 49 | 47 | 35 | 32 | 44 | 43 | 44 | 40 | 47 | 47 | 44 | 44 | 42 | 43 | 45 | 44 | 44 |
| " | " | 5:00p | 47 | 45 | 40 | 40 | 41 | 43 | 44 | 38 | 47 | 46 | 41 | 44 | 39 | 40 | 45 | 43 | 43 |
| " | " | 6:00p | 46 | 45 | 40 | 40 | 41 | 43 | 45 | 38 | 47 | 46 | 41 | 44 | 39 | 40 | 45 | 43 | 43 |
| " | " | 6:30p | 45 | 43 | 39 | 39 | 39 | 42 | 44 | 37 | 47 | 45 | 40 | 43 | 38 | 39 | 44 | 42 | 42 |
| " | " | 8:00p | 45 | 43 | 39 | 39 | 39 | 42 | 44 | 37 | 47 | 45 | 40 | 43 | 38 | 39 | 44 | 42 | 42 |
| " | " | 9:00p | 44 | 41 | 38 | 38 | 37 | 41 | 43 | 36 | 46 | 43 | 38 | 41 | 36 | 37 | 43 | 41 | 40 |
| N.Y.C. | 10/27 | 2:00p | 53 | 37 | 34 | 36 | 35 | 39 | 39 | 36 | 41 | 39 | 36 | 38 | 34 | 36 | 39 | 37 | 37 |
| St.Ls. 2/ | 10/30 | 3:00p | 87 | 35 | 35 | 43 | 44 | 35 | 38 | 34 | 37 | 36 | 33 | 34 | 34 | 37 | 35 | 36 | 36 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST = outside air temperature.

2/ This car was unloaded at Fairmont City, Illinois.

Table 6. Summary of temperatures obtained with resistance thermometers in Car 6.
Fan car shipped with top ice only.

| | | | | Air Temp. (° F.) 1/ | | | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 10/26 | 3:15p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 3:20p | 54 | 51 | 53 | 54 | 45 | 44 | 50 | 45 | 47 | 47 | 48 | 46 | 45 | 46 | 46 | 47 | 46 |
| " | " | 3:40p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 3:50p | 52 | 44 | 46 | 37 | 45 | 44 | 49 | 42 | 46 | 47 | 44 | 45 | 43 | 44 | 45 | 46 | 45 |
| " | " | 4:00p | 49 | 40 | 42 | 39 | 44 | 43 | 48 | 40 | 46 | 46 | 42 | 44 | 42 | 42 | 44 | 45 | 44 |
| " | " | 5:00p | 47 | 38 | 39 | 39 | 44 | 43 | 47 | 39 | 45 | 45 | 41 | 43 | 41 | 41 | 44 | 44 | 43 |
| " | " | 6:00p | 46 | 39 | 38 | 39 | 45 | 43 | 48 | 39 | 45 | 45 | 41 | 43 | 41 | 42 | 44 | 45 | 43 |
| " | " | 6:30p | 45 | 38 | 38 | 39 | 45 | 43 | 48 | 39 | 45 | 45 | 41 | 43 | 41 | 42 | 44 | 45 | 43 |
| " | " | 8:00p | 45 | 37 | 37 | 37 | 45 | 43 | 46 | 38 | 44 | 44 | 40 | 39 | 41 | 41 | 42 | 44 | 42 |
| " | " | 9:00p | 44 | 37 | 37 | 37 | 45 | 43 | 46 | 37 | 44 | 44 | 40 | 40 | 41 | 41 | 42 | 44 | 42 |
| N.Y.C. | 10/27 | 2:00p | 53 | 35 | 35 | 36 | 39 | 40 | 39 | 35 | 43 | 41 | 36 | 37 | 37 | 37 | 40 | 39 | 39 |
| St.Louis | 10/30 | 7:10p | 76 | 34 | 35 | 44 | 35 | 36 | 36 | 34 | 34 | 34 | 34 | 35 | 34 | 34 | 35 | 35 | 35 |
| " " | 10/31 | 9:30a | 81 | 34 | 35 | 43 | 35 | 36 | 36 | 34 | 35 | 35 | 34 | 35 | 34 | 34 | 35 | 35 | 35 |
| " " | " | 3:35p | 85 | 34 | 35 | 49 | 36 | 36 | 37 | 34 | 35 | 36 | 35 | 35 | 35 | 35 | 35 | 36 | 35 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST = outside air temperature.

Table 7. Summary of temperatures obtained with resistance thermometers in Car 7.
Non-fan car shipped with top ice only.

| | | | Air Temp. (° F.) 1/ | | | | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 10/30 | 2:20p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 2:34p | 74 | 64 | 68 | 73 | 63 | 63 | 64 | 65 | 65 | 66 | 64 | 62 | 63 | 64 | 63 | 64 | 64 |
| " | " | 3:30p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 3:30p | 74 | 52 | 61 | 43 | 63 | 61 | 63 | 65 | 64 | 65 | 64 | 63 | 63 | 64 | 62 | 64 | 63 |
| " | " | 4:00p | 72 | 48 | 56 | 47 | 61 | 59 | 60 | 61 | 62 | 63 | 61 | 63 | 62 | 61 | 61 | 62 | 61 |
| " | " | 4:30p | 68 | 48 | 52 | 47 | 59 | 57 | 59 | 57 | 60 | 63 | 59 | 63 | 61 | 58 | 60 | 61 | 60 |
| " | " | 5:00p | 67 | 48 | 50 | 47 | 58 | 57 | 57 | 55 | 59 | 62 | 57 | 63 | 59 | 57 | 60 | 59 | 59 |
| " | " | 5:30p | 65 | 46 | 48 | 46 | 57 | 55 | 57 | 53 | 58 | 61 | 56 | 62 | 59 | 55 | 58 | 59 | 58 |
| " | " | 6:00p | 64 | 45 | 46 | 45 | 56 | 55 | 55 | 51 | 57 | 60 | 54 | 62 | 57 | 54 | 58 | 57 | 56 |
| " | " | 6:30p | 62 | 44 | 45 | 45 | 55 | 54 | 55 | 50 | 56 | 59 | 53 | 61 | 57 | 53 | 57 | 57 | 56 |
| " | " | 8:30p | 61 | 42 | 42 | 44 | 52 | 51 | 52 | 47 | 54 | 57 | 49 | 61 | 53 | 49 | 55 | 54 | 53 |
| N.Y.C. | 10/31 | 8:00p | 64 | 38 | 37 | 41 | 39 | 42 | 41 | 40 | 40 | 41 | 40 | 48 | 39 | 40 | 43 | 40 | 41 |
| Detroit | 11/3 | 11:00a | 40 | 33 | 36 | 35 | 34 | 35 | 35 | 34 | 34 | 36 | 35 | 37 | 35 | 34 | 35 | 35 | 35 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle, (top of second layer of four), T = top.
OST = outside air temperature.

Table 8. Summary of temperatures obtained with resistance thermometers in Car 8.
Non-fan car shipped with top ice and with upper half bunker ice (initial icing only).

| | | | | Air Temp. (° F.) 1/ | | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 10/30 | 2:30p | | Loading completed - bunkers iced. | | | | | | | | | | | | | | | |
| " | " | 2:35p | 74 | 65 | 66 | 72 | 64 | 64 | 62 | 62 | 64 | 65 | 59 | 60 | 59 | 62 | 63 | 62 | 62 |
| " | " | 3:25p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 3:30p | 74 | 58 | 59 | 48 | 58 | 58 | 60 | 56 | 60 | 62 | 58 | 58 | 57 | 57 | 59 | 60 | 59 |
| " | " | 4:00p | 72 | 52 | 54 | 46 | 55 | 56 | 58 | 54 | 59 | 60 | 56 | 56 | 54 | 55 | 57 | 57 | 56 |
| " | " | 4:30p | 68 | 48 | 51 | 45 | 53 | 54 | 56 | 53 | 58 | 58 | 55 | 55 | 53 | 54 | 56 | 56 | 55 |
| " | " | 5:00p | 67 | 47 | 50 | 45 | 52 | 53 | 55 | 52 | 57 | 57 | 54 | 54 | 52 | 53 | 55 | 55 | 54 |
| " | " | 5:30p | 65 | 46 | 49 | 44 | 50 | 52 | 54 | 51 | 56 | 56 | 53 | 53 | 51 | 51 | 54 | 54 | 53 |
| " | " | 6:00p | 64 | 44 | 47 | 43 | 50 | 51 | 53 | 50 | 56 | 54 | 53 | 52 | 50 | 51 | 53 | 52 | 52 |
| " | " | 6:30p | 62 | 44 | 46 | 43 | 48 | 50 | 52 | 49 | 55 | 52 | 51 | 51 | 49 | 49 | 52 | 51 | 51 |
| " | " | 8:30p | 61 | 40 | 43 | 41 | 45 | 47 | 51 | 47 | 51 | 49 | 49 | 48 | 46 | 47 | 49 | 49 | 48 |
| N.Y.C. | 10/31 | 7:50p | 64 | 36 | 36 | 40 | 36 | 36 | 37 | 40 | 38 | 37 | 37 | 37 | 36 | 38 | 37 | 37 | 37 |
| Detroit | 11/3 | 10:55a | 40 | 34 | 34 | 34 | 34 | 34 | 35 | 34 | 34 | 34 | 33 | 35 | 34 | 34 | 34 | 34 | 34 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four ), T = top.
OST - outside air temperature.

Table 9. Summary of temperatures obtained with resistance thermometers in Car 9.
Fan car shipped with top ice only.

| | | | Air Temp. (° F.) 1/ | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 11/8 | 3:35p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 3:40p | 63 | 61 | 61 | 62 | 58 | 60 | 60 | 60 | 60 | 61 | 63 | 61 | 59 | 60 | 60 | 60 | 60 |
| " | " | 4:45p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 4:50p | 58 | 53 | 42 | 32 | 57 | 61 | 60 | 58 | 57 | 59 | 60 | 62 | 58 | 58 | 60 | 59 | 59 |
| " | " | 5:20p | 58 | 53 | 40 | 39 | 55 | 61 | 60 | 57 | 55 | 57 | 59 | 60 | 57 | 57 | 59 | 58 | 58 |
| " | " | 5:50p | 56 | 53 | 39 | 39 | 54 | 61 | 60 | 57 | 54 | 57 | 57 | 59 | 55 | 56 | 58 | 57 | 57 |
| " | " | 6:50p | 54 | 50 | 38 | 41 | 52 | 60 | 60 | 55 | 52 | 54 | 55 | 57 | 53 | 54 | 56 | 56 | 55 |
| " | " | 8:20p | 53 | 48 | 36 | 40 | 48 | 60 | 59 | 54 | 50 | 52 | 54 | 56 | 51 | 52 | 55 | 54 | 54 |
| " | " | 8:50p | 53 | 48 | 36 | 40 | 49 | 60 | 59 | 53 | 49 | 51 | 53 | 55 | 50 | 52 | 55 | 53 | 53 |
| N.Y.C. | 11/9 | 2:35p | 67 | 36 | 33 | 41 | 39 | 49 | 44 | 45 | 41 | 39 | 43 | 46 | 39 | 42 | 45 | 41 | 43 |
| Chicago | 11/12 | 5:10p | 32 | 32 | 32 | 33 | 33 | 34 | 35 | 34 | 33 | 34 | 34 | 35 | 34 | 34 | 34 | 34 | 34 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST - outside air temperature.

Table 10. Summary of temperatures obtained with resistance thermometers in Car 10.
Fan car shipped dry (i.e. without top ice) under standard refrigeration.

| | | | Air Temp. (° F.) 1/ | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 11/8 | 3:25p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 3:40p | 63 | 62 | 63 | 64 | 61 | 62 | 60 | 57 | 64 | 61 | 62 | 63 | 60 | 61 | 63 | 60 | 61 |
| " | " | 4:45p | | Bunkers iced. | | | | | | | | | | | | | | | |
| " | " | 4:50p | 58 | 47 | 54 | 64 | 61 | 62 | 60 | 59 | 64 | 61 | 62 | 63 | 61 | 61 | 63 | 61 | 61 |
| " | " | 5:20p | 58 | 43 | 51 | 63 | 61 | 62 | 59 | 58 | 64 | 60 | 62 | 63 | 61 | 60 | 63 | 60 | 61 |
| " | " | 5:50p | 56 | 42 | 50 | 62 | 61 | 62 | 59 | 59 | 64 | 60 | 62 | 62 | 60 | 61 | 63 | 60 | 61 |
| " | " | 6:50p | 54 | 41 | 48 | 61 | 62 | 63 | 56 | 59 | 64 | 59 | 62 | 62 | 60 | 61 | 63 | 58 | 61 |
| " | " | 8:20p | 53 | 40 | 45 | 61 | 62 | 63 | 54 | 60 | 64 | 58 | 62 | 60 | 59 | 61 | 62 | 57 | 60 |
| " | " | 8:50p | 53 | 40 | 45 | 61 | 62 | 63 | 54 | 60 | 64 | 57 | 62 | 60 | 58 | 61 | 62 | 56 | 60 |
| N.Y.C. | 11/9 | 2:35p | 67 | 37 | 41 | 58 | 59 | 53 | 42 | 56 | 56 | 47 | 55 | 50 | 47 | 57 | 53 | 45 | 52 |
| Chicago | 11/12 | 5:15p | 32 | 34 | 34 | 37 | 38 | 37 | 35 | 36 | 37 | 35 | 36 | 36 | 35 | 37 | 37 | 35 | 36 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST= outside air temperature.

Table 11. Summary of temperatures obtained with resistance thermometers in Car 11.
Fan car shipped with top ice only.

| | | | | Air Temp. (° F.) 1/ | | | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 11/9 | 3:15p | | Loading completed. | | | | | | | | | | | | | | | |
| " | " | 3:20p | 65 | 63 | 64 | 65 | 63 | 63 | 64 | 62 | 65 | 61 | 62 | 59 | 63 | 62 | 62 | 63 | 62 |
| " | " | 5:15p | | Top iced. | | | | | | | | | | | | | | | |
| " | " | 5:20p | 59 | 45 | 53 | 35 | 63 | 62 | 63 | 61 | 64 | 61 | 62 | 60 | 61 | 62 | 62 | 62 | 62 |
| " | " | 5:50p | 59 | 45 | 46 | 35 | 61 | 60 | 61 | 60 | 62 | 60 | 61 | 59 | 59 | 61 | 60 | 60 | 60 |
| " | " | 6:20p | 59 | 46 | 43 | 35 | 60 | 59 | 60 | 59 | 61 | 60 | 60 | 58 | 57 | 60 | 59 | 59 | 59 |
| " | " | 7:20p | 59 | 46 | 41 | 35 | 58 | 58 | 58 | 57 | 58 | 58 | 58 | 57 | 55 | 58 | 58 | 57 | 57 |
| " | " | 8:20p | 59 | 46 | 40 | 35 | 56 | 56 | 57 | 55 | 56 | 56 | 55 | 56 | 53 | 55 | 56 | 55 | 56 |
| " | " | 9:20p | 59 | 45 | 39 | 35 | 54 | 55 | 56 | 53 | 55 | 54 | 53 | 54 | 51 | 53 | 55 | 54 | 54 |
| " | " | 9:50p | 59 | 44 | 38 | 34 | 54 | 54 | 55 | 52 | 54 | 53 | 52 | 54 | 50 | 53 | 54 | 53 | 53 |
| N.Y.C. | 11/10 | 9:15p | 45 | 35 | 34 | 35 | 36 | 38 | 39 | 36 | 38 | 37 | 36 | 39 | 36 | 36 | 38 | 37 | 37 |
| Chicago | 11/13 | 1:50p | 33 | 32 | 33 | 33 | 34 | 33 2/ | 32 | 33 | 35 | 34 | 35 | 34 2/ | 33 | 34 | 34 | 33 | 34 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST = outside air temperature.

2/ Taken manually.

Table 12. Summary of temperatures obtained with resistance thermometers in Car 12.
Fan car, precooled, and shipped dry (i.e. without top ice) under standard refrigeration.

| | | | Air Temp. (° F.) 1/ | Commodity Temperatures (° F.) 1/ | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | Time | OST | BB | BD | TD | TB | MB | BB | TQ | MQ | BQ | TD | MD | BD | Av. Top | Av. Mid. | Av. Bot. | Av. Car |
| Riverhd. | 11/9 | 3:20p | Loading completed; bunkers half full of ice, fans started. | | | | | | | | | | | | | | | | |
| " | " | 3:20p | 65 | 52 | 53 | 64 | 62 | 62 | 61 | 60 | 54 | 52 | 62 | 64 | 60 | 61 | 60 | 58 | 60 |
| " | " | 3:30p | 64 | 52 | 51 | 51 | 61 | 62 | 59 | 59 | 53 | 52 | 61 | 63 | 59 | 60 | 59 | 57 | 59 |
| " | " | 3:45p | 63 | 51 | 51 | 51 | 60 | 62 | 59 | 58 | 53 | 53 | 61 | 63 | 59 | 60 | 59 | 57 | 59 |
| " | " | 4:00p | 62 | 51 | 51 | 49 | 59 | 61 | 59 | 57 | 53 | 53 | 59 | 63 | 58 | 58 | 59 | 57 | 58 |
| " | " | 4:15p | 61 | 50 | 51 | 49 | 59 | 61 | 59 | 56 | 52 | 53 | 59 | 63 | 58 | 58 | 59 | 57 | 58 |
| " | " | 4:30p | 60 | 50 | 51 | 49 | 58 | 60 | 59 | 56 | 52 | 53 | 59 | 62 | 57 | 58 | 58 | 56 | 57 |
| " | " | 4:45p | 60 | 50 | 50 | 48 | 58 | 61 | 58 | 55 | 52 | 53 | 58 | 62 | 57 | 57 | 58 | 56 | 57 |
| " | " | 5:00p | Bunkers replenished. | | | | | | | | | | | | | | | | |
| " | " | 5:05p | 60 | 49 | 48 | 44 | 57 | 60 | 58 | 54 | 51 | 53 | 58 | 62 | 56 | 56 | 58 | 56 | 57 |
| " | " | 5:20p | 59 | 46 | 47 | 43 | 56 | 59 | 57 | 53 | 50 | 52 | 57 | 61 | 55 | 55 | 57 | 55 | 56 |
| " | " | 5:50p | 59 | 44 | 46 | 42 | 54 | 58 | 56 | 51 | 49 | 52 | 55 | 61 | 54 | 53 | 56 | 54 | 54 |
| " | " | 6:20p | 59 | 43 | 45 | 42 | 52 | 56 | 54 | 49 | 47 | 51 | 54 | 60 | 52 | 52 | 54 | 52 | 53 |
| " | " | 7:20p | 59 | 41 | 43 | 40 | 49 | 54 | 52 | 46 | 45 | 49 | 52 | 58 | 50 | 49 | 52 | 50 | 51 |
| " | " | 8:20p | 59 | 40 | 41 | 39 | 47 | 51 | 49 | 43 | 43 | 47 | 50 | 56 | 47 | 47 | 50 | 48 | 48 |
| " | " | 9:20p | 59 | 40 | 40 | 39 | 45 | 49 | 47 | 42 | 42 | 45 | 49 | 53 | 45 | 45 | 48 | 46 | 46 |
| " | " | 9:20p | Fans stopped. | | | | | | | | | | | | | | | | |
| N.Y.C. | 11/10 | 5:00p | 55 | - | 37 | - | 46 | 46 | 42 | 43 | 44 | 43 | 47 | 48 | 44 | 45 | 46 | 43 | 45 |
| Chicago | 11/13 | 9:45a | 34 | - | 32 | - | 36 | 35 | 35 | 34 | 35 | 34 | 35 | 36 | 36 | 35 | 35 | 35 | 35 |

1/ All temperatures taken in centerline of car.
Positions: B = bunker, Q = quarterlength, D = doorway.
Layers: B = bottom, M = middle (top of second layer of four), T = top.
OST = outside air temperature.

Table 13. Transit temperatures obtained with Ryan recording thermometers, October-November, 1950.

| Car No. | Date Shipped | Location of Ryan in load (layer) 1/ | Temperatures (° F.) at twelve-hour intervals: Start 2/ | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 | 156 | 168 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Non-fan car, top ice only, St. Louis | | | | | | | | | | | | | | | |
| 1 | 10/10 | 2 | 69 | 48 | 41 | 37 | 35 | 35 | 34 | 34 | 34 | 33 | 33 | | | | |
| | | 4 | 69 | 49 | 42 | 39 | 39 | 36 | 35 | 34 | 33 | 33 | 33 | | | | |
| | | Non-fan car, top ice and initial bunker ice (full bunkers), New Orleans | | | | | | | | | | | | | | | |
| 2 | 10/10 | 2 | 63 | 50 | 46 | 42 | 39 | 39 | 39 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| | | 4 | 65 | 51 | 42 | 38 | 36 | 35 | 34 | 34 | 34 | 33 | 33 | 33 | 33 | 33 | 33 |
| | | Non-fan car, top ice only, St. Louis | | | | | | | | | | | | | | | |
| 3 | 10/11 | 2 | 60 | 53 | 48 | 44 | 40 | 38 | 36 | 36 | 35 | 34 | 34 | 34 | 34 | 34 | 34 |
| | | 4 | 61 | Failed to operate. | | | | | | | | | | | | | |
| | | Fan car, precooled, dry load, standard refrigeration, St. Louis | | | | | | | | | | | | | | | |
| 4 | 10/12 | 2 | 60 | 41 | 37 | 38 | 38 | 38 | 38 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 39 |
| | | 4 | 61 | 42 | 40 | 36 | 38 | 38 | 37 | 37 | 36 | 36 | 37 | 36 | 36 | 39 | 40 |
| | | Non-fan car, top ice only, St. Louis | | | | | | | | | | | | | | | |
| 5 | 10/26 | 1 | 49 | 41 | 38 | 36 | 35 | 35 | 35 | 35 | 35 | | | | | | |
| | | 3 | 47 | 44 | 41 | 39 | 38 | 38 | 38 | 38 | 37 | | | | | | |
| | | Fan car, top ice only, St. Louis | | | | | | | | | | | | | | | |
| 6 | 10/26 | 1 | 49 | 41 | 39 | 37 | 37 | 36 | 36 | 36 | 36 | 36 | 37 | | | | |
| | | 3 | 47 | 45 | 42 | 37 | 36 | 35 | 35 | 34 | 34 | 35 | 36 | | | | |
| | | Non-fan car, top ice only, Detroit | | | | | | | | | | | | | | | |
| 7 | 10/30 | 1 | 68 | 49 | 43 | 39 | 37 | 37 | 36 | 35 | 35 | | | | | | |
| | | 3 | 64 | 48 | 41 | 40 | 38 | 36 | 35 | 33 | 33 | | | | | | |
| | | Non-fan car, top ice and initial upper-half stage bunker ice, Detroit. | | | | | | | | | | | | | | | |
| 8 | 10/30 | 1 | 65 | 46 | 37 | 36 | 35 | 34 | 34 | 33 | 33 | | | | | | |
| | | 3 | 64 | 44 | 40 | 37 | 35 | 34 | 33 | 33 | 33 | | | | | | |

Table 13 (continued). Transit temperatures obtained with Ryan recording thermometers, October-November, 1950.

| Car No. | Date Shipped | Location of Ryan in load (layer) [1/] | Temperatures (° F.) at twelve-hour intervals | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Start [2/] | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 | 156 | 168 |
| | | Fan car, top ice only, Chicago | | | | | | | | | | | | | | | |
| 9 | 11/8 | 1 | 62 | 57 | 40 | 35 | 33 | 32 | 32 | 32 | 32 | 33 | | | | | |
| | | 3 | 60 | 43 | 40 | 35 | 33 | 32 | 32 | 32 | 32 | 33 | | | | | |
| | | Fan car, dry load, standard refrigeration, Chicago. | | | | | | | | | | | | | | | |
| 10 | 11/8 | 1 | 62 | 52 | 43 | 43 | 39 | 37 | 36 | 34 | 34 | 34 | | | | | |
| | | 3 | 64 | 55 | 55 | 47 | 39 | 37 | 36 | 35 | 36 | 37 | | | | | |
| | | Fan car, top ice only, Chicago | | | | | | | | | | | | | | | |
| 11 | 11/9 | 1 | 62 | 51 | 40 | 37 | 33 | 33 | 33 | 33 | 33 | | | | | | |
| | | 3 | 61 | 50 | 37 | 32 | 32 | 32 | 32 | 32 | 32 | | | | | | |
| | | Fan car, precooled, dry load, standard refrigeration, Chicago | | | | | | | | | | | | | | | |
| 12 | 11/9 | 1 | 62 | - | - | - | - | 38 | 36 | 36 | 36 | 36 | 36 | | | | |
| | | 3 | 61 | 54 | 42 | 43 | 41 | 37 | 36 | 35 | 35 | 35 | 36 | | | | |

1/ 1 = bottom layer, 2 = next to bottom layer, 3 = next to top layer, 4 = top layer. All Ryans located at quarterlength, centerline of car.

2/ Start = Time the cauliflower crates with Ryan recording thermometers were placed in position inside the car.

Table 14. Summary of icing records for twelve test cars of Long Island cauliflower shipped during October and November, 1950. 1/

| Car No. | Initial top ice (lbs.) | Initial bunker ice (lbs.) | Reice (bunker) (lbs.) | Total ice (lbs.) | Ice remaining at destination (lbs.) | Ice melted in transit (lbs.) |
|---|---|---|---|---|---|---|
| 1 | 18,000 | - | - | 18,000 | 2,000 | 16,000 |
| 2 | 18,000 | 9,600 | - | 27,600 | 1500 top) 4800 bunker) 6,300 | 21,300 |
| 3 | 18,000 | - | - | 18,000 | 1,500 | 16,500 |
| 4 | - | 16,700 2/ | 7,500 | 24,200 | 9,900 | 14,300 |
| 5 | 18,000 | - | - | 18,000 | 7,500 | 10,500 |
| 6 | 18,000 | - | - | 18,000 | 6,000 | 12,000 |
| 7 | 18,000 | - | - | 18,000 | 6,000 | 12,000 |
| 8 | 18,000 | 4,800 | - | 22,800 | 7500 top ) 2400 bunker) 9,900 | 12,900 |
| 9 | 18,000 | - | - | 18,000 | 6,000 | 12,000 |
| 10 | - | 10,000 | 5,000 | 15,000 | 6,200 | 8,800 |
| 11 | 18,000 | - | - | 18,000 | 7,500 | 10,500 |
| 12 | - | 18,800 3/ | 7,400 | 18,200 | 8,700 | 9,500 |

1/ All estimates of ice supplied were based on block counts.

2/ Includes 11,300 pounds initial icing and 5,400 pounds reicing during precooling period.

3/ Includes 4,800 pounds initial icing and 6,000 pounds reicing about two hours after start of precooling period.

Figure 1
Car No. 1 - Non fan, top iced
vs.
Car No. 2 - Non fan, top iced, full bunkers (initial icing only)
Average car temperatures
(resistance thermometers)

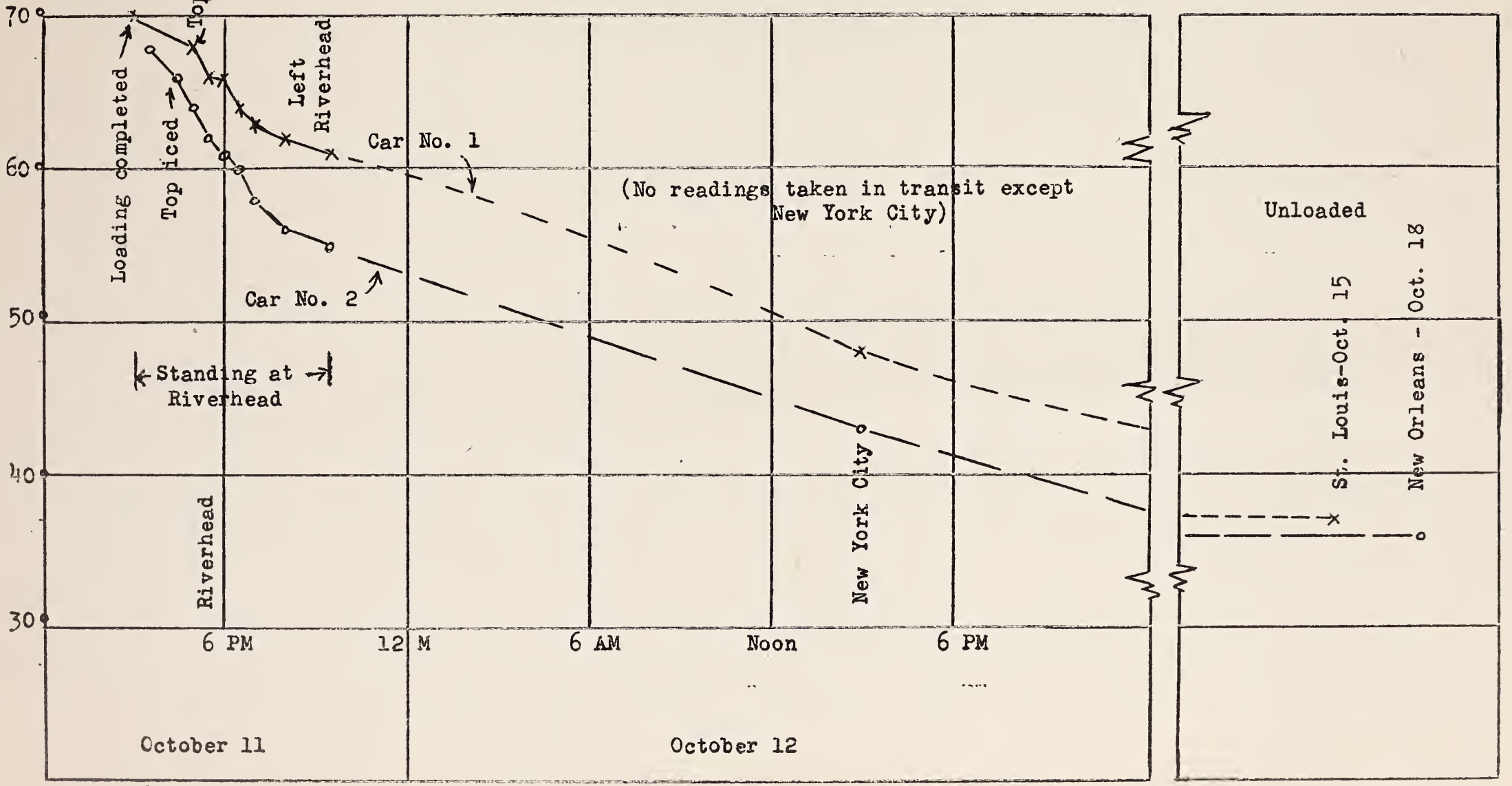

Figure 2
Car No. 3 - Non fan, top iced
vs.
Car No. 4 - Pre-cooled, shipped dry (no top ice) Std. refrigeration
Average car temperatures
(resistance thermometers)

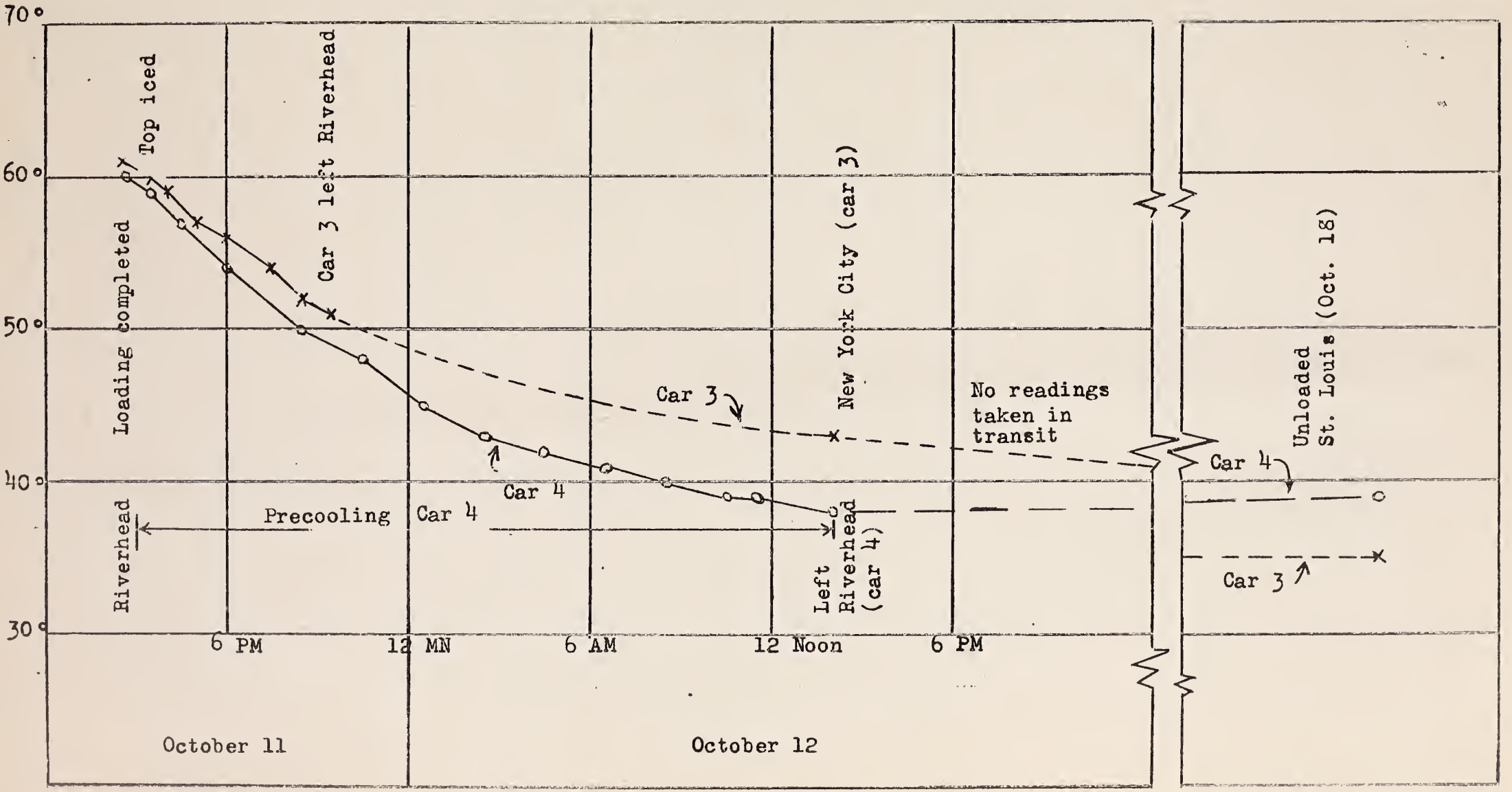

Figure 3
Car No. 5 - Non fan, top iced
vs.
Car No. 6 - Fan, top iced
Average car temperatures
(resistance thermometers)

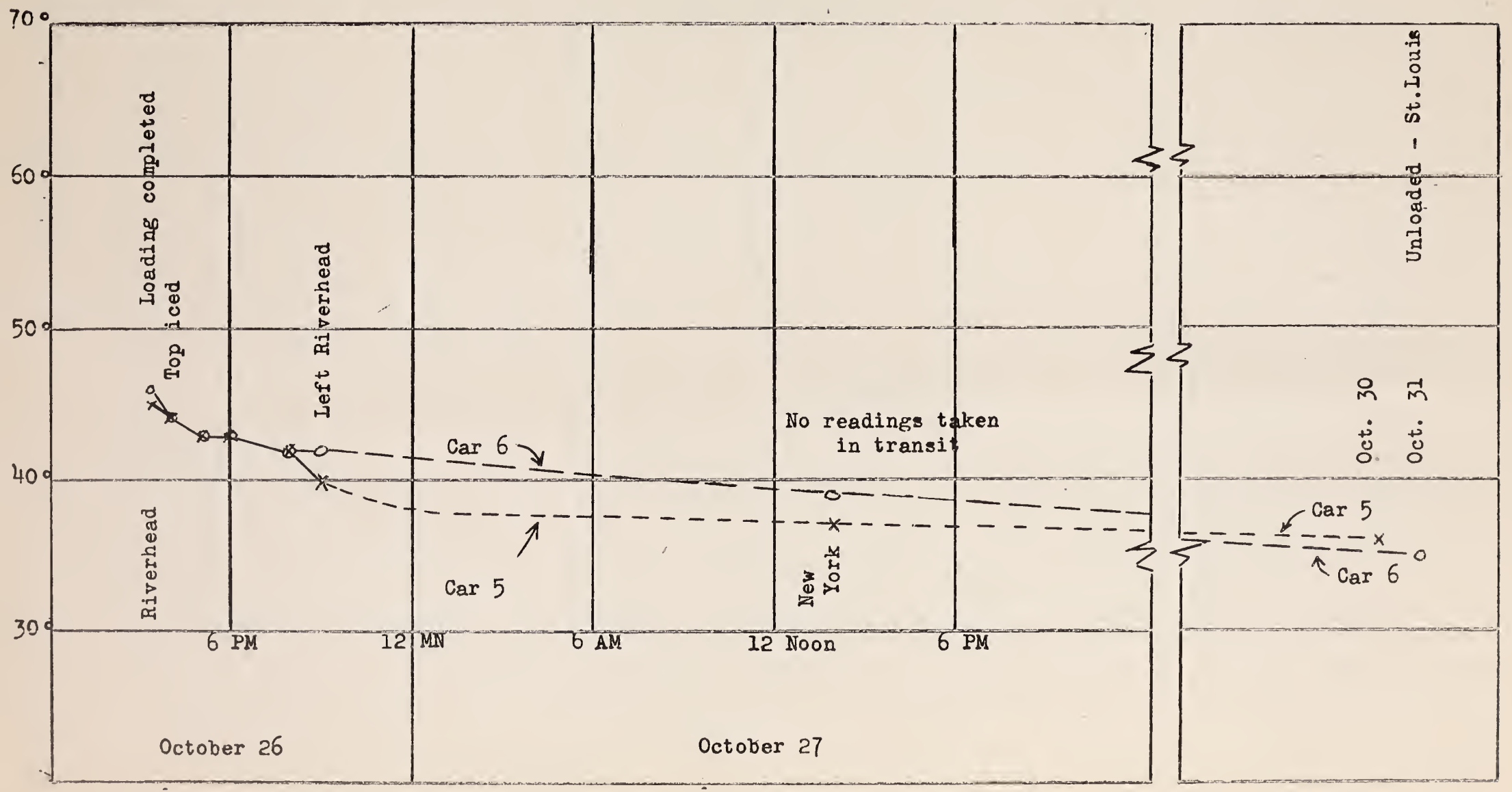

Figure 4
Car No. 7 - Non fan, top iced
vs.
Car No. 8 - Non fan, top ice, half stage bunker initial icing
Average car temperatures
(resistance thermometers)

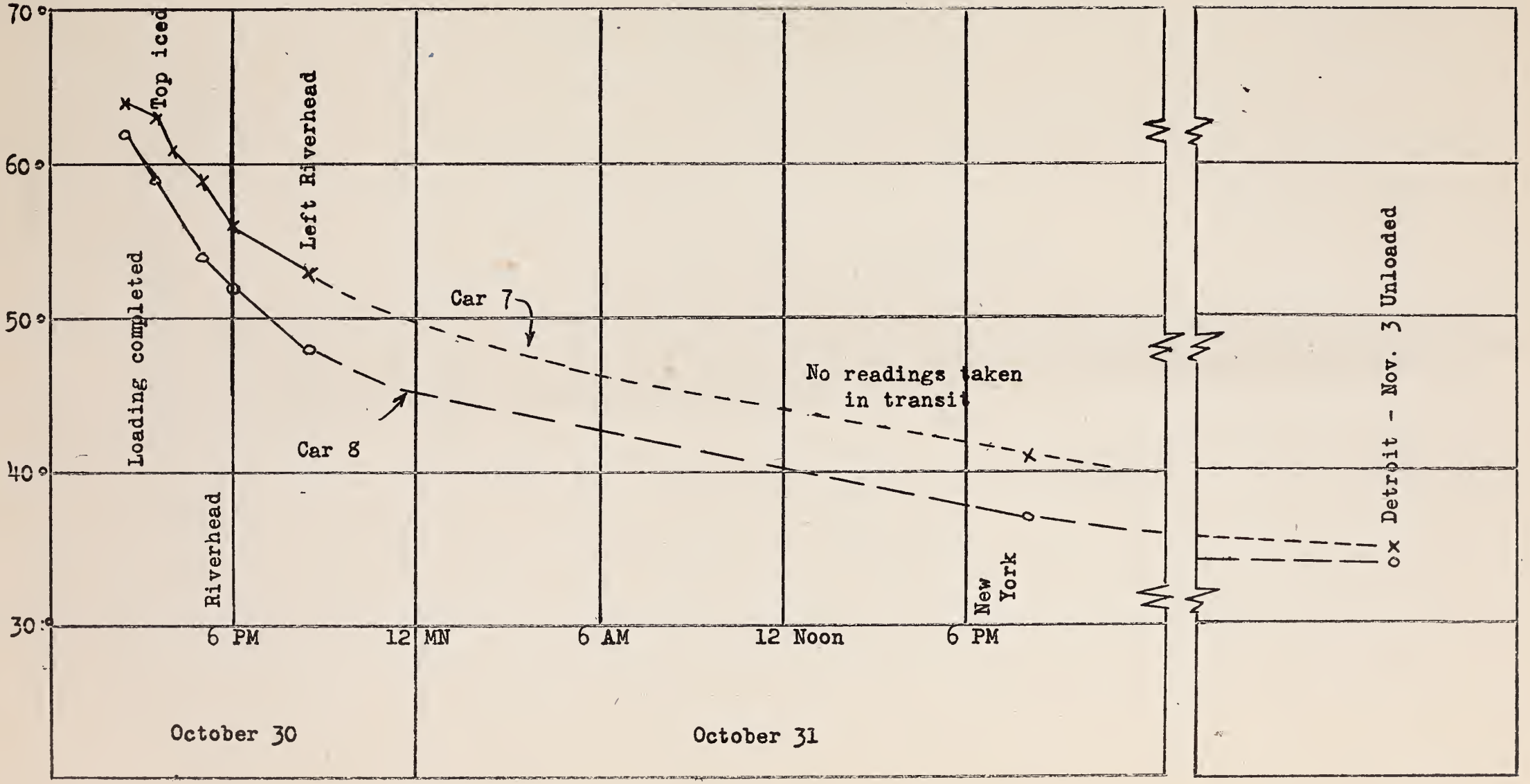

Figure 5
Car No. 9 - Fan, top iced
vs.
Car No. 10 - Fan, dry (no top ice) Std. refrig. (initial icing)
Average car temperatures
(resistance thermometers)

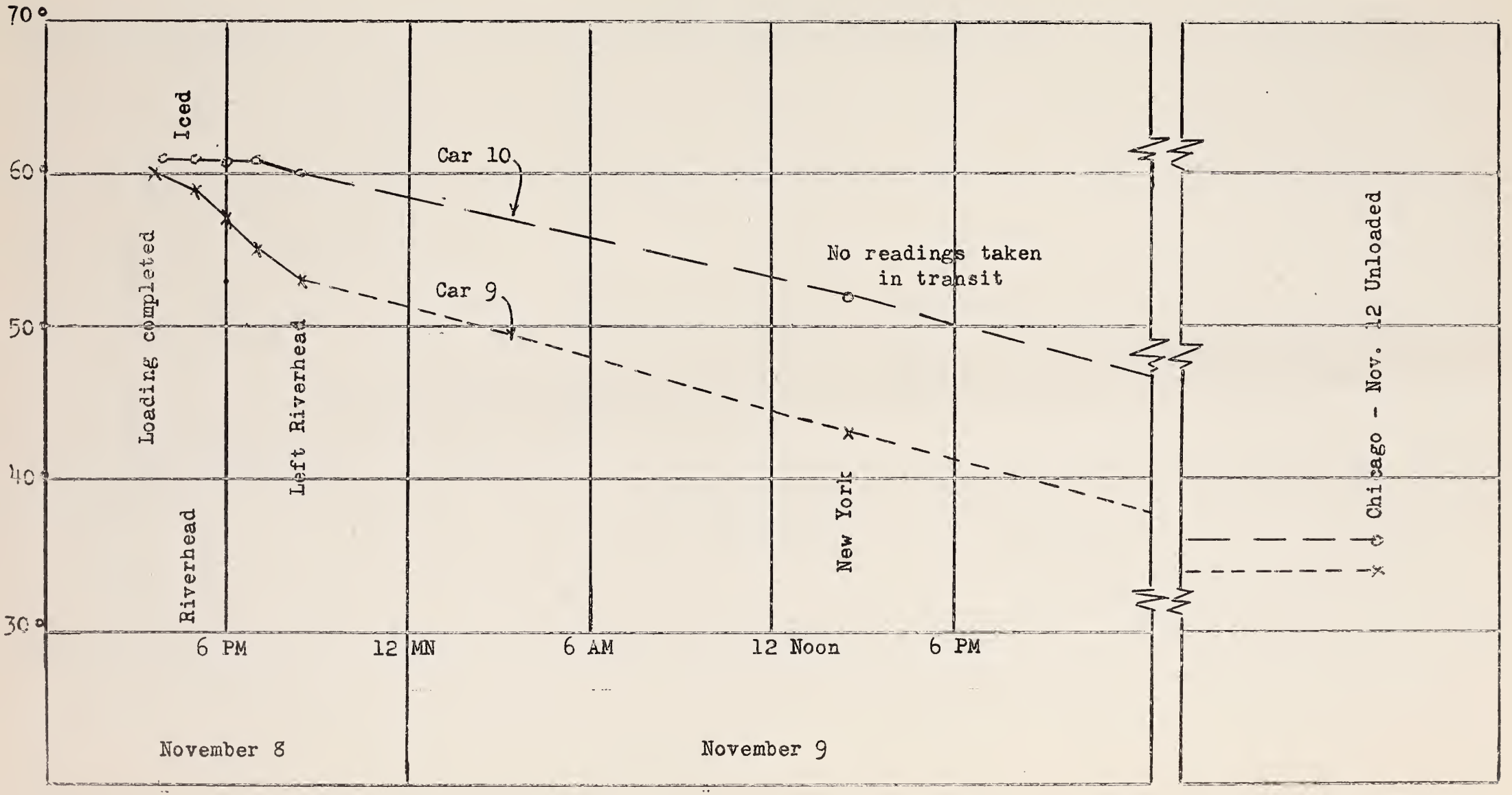

Figure 6
Car No. 11 - Fan, top iced
vs.
Car No. 12 - Fan, precooled 6 hrs., Dry, Std. refrig. (initial icing)
Average car temperatures
(resistance thermometers)